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LETTERS TO THE EDITOR.

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The Subtropical Zones of High Barometric Pressure.

THERE is an old theory, if a mere popular notion which has no scientific basis whatever may be so called, that the two zones of high barometric pressure, extending with a few interruptions around the globe, and having their maxima of pressure about the parallel of 35° in the northern hemisphere, and 30° in the southern, are caused by the crowding of the air, in its passage in the upper part of the atmosphere from the equatorial to the polar regions, into intermeridian spaces, becoming gradually narrower toward the poles. It is supposed that the air, as it is forced into narrower spaces, is turned down toward the earth's surface, and that this descent of the air causes increased pressure on the surface. The barometric pressure in both hemispheres increases from the poles, or at least from some high parallel, toward the equator, until the parallels above mentioned are reached, and then there is a small decrease of pressure to the equator; so that these parallels are simply the limits between the increasing and decreasing pressure gradients in going from the pole to the equator, and the culminating parallels of the convexity of the isobaric surfaces.

The writer's attention was first directed to this feature of these isobaric surfaces about thirty-five years ago, in reading Lieut. Maury's "Physical Geography of the Sea;" and, having no faith in the popular explanation, he made it a matter of study in order to discover the true cause. This was found in the now well-known

law of the deflecting force of the earth's rotation, which was first discovered at that time. By this law the air, in moving from west to east in the middle and higher latitudes, is pressed toward the equator; but, in moving the contrary way in the lower latitudes, it is pressed a little toward the poles, thus causing a bulging-up of the isobaric surfaces with the culminating lines between the two systems of easterly and westerly currents about the parallels of 35° or 30°. The results were published in an "Essay on the Winds and the Currents of the Ocean," which was subsequently republished in "Professional Paper of the Signal Service," No. XII.

Subsequently this whole subject was treated in a more thorough and mathematical manner, and the results were published in a memoir entitled "Motions of Fluids and Solids Relative to the Earth's Surface." This was afterwards republished in "Professional Paper of the Signal Service," No. VIII., with extensive notes by Professor Frank Waldo. In this memoir it was shown that with certain assumed values for the velocities of the easterly and westerly motions of the air, which were quite reasonable and probable from what was known of these somewhat uncertain data, the deflecting force of the earth's rotation would give the observed increase of pressure, on the one hand from the pole, and on the other from the equator; so that there was no room to doubt that the maximum pressure a little above the tropics in each hemisphere was caused by this force. A very full abstract of this memoir was also given in *Silliman's Journal*, January, 1861.

Subsequently this same subject was taken up again, and treated in a more thorough manner and with better data, and the results published in "Meteorological Researches," Part I., "Coast Survey Report for 1875."

The same subject was again treated by the use of mathematical processes somewhat simplified, and given in "Recent Advances in Meteorology," forming Part II. of the "Report of the Chief Signal Officer for 1885."

Finally the whole matter was gone over again by the writer in a popular manner, and explained by means of various simple illustrations, and was given in his "Popular Treatise on the Winds," etc.

Dr. Hann, however, has not accepted the results, nor has he ever attempted to show that they have been deduced from erroneous principles or processes, but has continued to use and uphold the old theory. Not only this, but he has based upon it a new theory with regard to the cause of the high-pressure areas of the middle and higher latitudes. In the *Zeitschrift für Meteorologie* for 1879, p. 39, he first suggests that these regions of high barometric pressure may be simply the places where the upper equatorial and westerly currents settle down towards the earth's surface, as in the case of the zones of high pressure at the polar limits of the trade-winds. His idea is, that as the upper poleward-moving currents in the latter are deflected down by their being crowded between intermeridian spaces, gradually becoming narrower toward the poles, so, even beyond these belts of high pressure, there must be local hinderances, or a damming-up of these currents, by which they pass into descending ones toward the earth, and so cause the high-pressure areas.

In the next volume of the *Zeitschrift* he again refers to this matter, and suggests that the reason why cyclones and great barometric disturbances are more frequent in winter than in summer is that in winter the temperature and pressure gradients of the upper strata of the atmosphere, in a poleward direction, are greater, and hence there is a greater strength of current at this season of the year.

Again, in his "Climatology," published a few years ago, this same old theory is given in explanation of the subtropical zones of high pressure.

Finally, in his recent memoir published by the Royal Academy of Sciences of Vienna, the old theory of the subtropical high-pressure belts is introduced, and also his new theory, deduced from it, of the causes of high-pressure areas; and he refers to his preceding papers in the *Zeitschrift* on these subjects.

Although the teaching of Dr. Hann on these subjects has been entirely at variance with the writer's own views on the same subjects, previously published at so many different times, yet he has